

## ArevaEPRDCPEm Resource

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**From:** WILLIFORD Dennis (AREVA) [Dennis.Williford@areva.com]  
**Sent:** Tuesday, August 30, 2011 9:28 AM  
**To:** Tesfaye, Getachew  
**Cc:** BENNETT Kathy (AREVA); CRIBB Arnie (EXTERNAL AREVA); DELANO Karen (AREVA); HALLINGER Pat (EXTERNAL AREVA); HATHCOCK Phillip (AREVA); ROMINE Judy (AREVA); RYAN Tom (AREVA); WELLS Russell (AREVA); WILLIAMSON Rick (AREVA); HARRINGTON James (AREVA)  
**Subject:** DRAFT Revised Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Question 03.09.02-161  
**Attachments:** RAI 467 Question 161 Response US EPR DC - DRAFT Rev 1.pdf

Getachew,

Attached is a draft response for RAI No. 467, FSAR Ch. 3, Question 03.09.02-161 as shown below in advance of the September 9, 2011 final date.

Let me know if the staff has questions or if this can be sent as a final response.

Thanks,

***Dennis Williford, P.E.***  
***U.S. EPR Design Certification Licensing Manager***  
***AREVA NP Inc.***  
7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Friday, August 05, 2011 10:37 AM  
**To:** Tesfaye, Getachew  
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WELLS Russell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 9

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions. AREVA NP submitted Supplement 2 on April 15, 2011, Supplement 3 on May 27, 2011, and Supplement 4 on June 22, 2011, to provide a revised schedule for 9 of the 10 remaining questions. AREVA NP submitted RAI 467 Supplement 5 on July 7, 2011, which provided a technically correct and complete response to 1 of the remaining 10 questions. AREVA NP submitted RAI 467 Supplement 6 on July 27, 2011, which provided a revised schedule for the remaining 9 questions. AREVA NP submitted RAI 467 Supplement 7 on July 29, 2011, which provided a technically correct and complete final responses to 3 of the remaining 9 questions. AREVA NP submitted RAI 467 Supplement 8 on August 3, 2011, which provided a technically correct and complete final response to 1 of the 6 remaining questions. The attached file, "RAI 467 Supplement 9 Response US EPR DC.pdf" provides technically correct and complete FINAL responses to 2 of the remaining 5 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 467 Supplement 9 Response US EPR DC.pdf" that contain AREVA NP's final response to the subject questions.

| Question #             | Start Page | End Page |
|------------------------|------------|----------|
| RAI 467 — 03.09.02-157 | 2          | 4        |
| RAI 467 — 03.09.02-165 | 5          | 5        |

The schedule for technically correct and complete final responses to the remaining 3 questions is unchanged as provided below.

| Question #             | Response Date      |
|------------------------|--------------------|
| RAI 467 — 03.06.03-28  | September 15, 2011 |
| RAI 467 — 03.09.02-160 | September 9, 2011  |
| RAI 467 — 03.09.02-161 | September 9, 2011  |

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WILLIFORD Dennis (RS/NB)  
**Sent:** Wednesday, August 03, 2011 12:38 PM  
**To:** 'Tefaye, Getachew'  
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WELLS Russell (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 8

Getachew,

AREVA NP Inc. letter NRC:11:084 dated August 2, 2011 provides a technically correct and complete final response to 1 of the 6 remaining questions in RAI 467. AREVA NP considers some of the material contained in the response to be proprietary information. As required by 10 CFR 2.390(b), an affidavit is provided to support the withholding of the proprietary information from public disclosure. Proprietary and non-proprietary versions of the enclosure to this letter are provided separately.

The following table indicates the respective pages in the enclosed response that contain AREVA NP's final response to the subject question.

| Question #             | Start Page | End Page |
|------------------------|------------|----------|
| RAI 467 — 03.09.02-163 | 2          | 5        |

The schedule for a technically correct and complete final response to Question 03.06.03-28 has been revised as shown below in bold. The schedule for technically correct and complete final responses to the remaining questions is unchanged as provided below.

| Question #             | Response Date             |
|------------------------|---------------------------|
| RAI 467 — 03.06.03-28  | <b>September 15, 2011</b> |
| RAI 467 — 03.09.02-157 | September 9, 2011         |
| RAI 467 — 03.09.02-160 | September 9, 2011         |
| RAI 467 — 03.09.02-161 | September 9, 2011         |

Sincerely,

**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**

**AREVA NP Inc.**  
 7207 IBM Drive, Mail Code CLT 2B  
 Charlotte, NC 28262  
 Phone: 704-805-2223  
 Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WELLS Russell (RS/NB)  
**Sent:** Friday, July 29, 2011 2:45 PM  
**To:** Tesfaye, Getachew  
**Cc:** WILLIFORD Dennis (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); RYAN Tom (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 7

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions. AREVA NP submitted Supplement 2 on April 15, 2011, Supplement 3 on May 27, 2011, and Supplement 4 on June 22, 2011, to provide a revised schedule for 9 of the 10 remaining questions. AREVA NP submitted RAI 467 Supplement 5 on July 7, 2011, which provided a technically correct and complete response to 1 of the remaining 10 questions. AREVA NP submitted RAI 467 Supplement 6 on July 27, 2011, which provided a revised schedule for the remaining 9 questions. The attached file, "RAI 467 Supplement 7 Response US EPR DC.pdf" provides technically correct and complete FINAL responses to 3 of the remaining 9 questions, as committed.

The following table indicates the respective pages in the response document, "RAI 467 Supplement 7 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

| Question #             | Start Page | End Page |
|------------------------|------------|----------|
| RAI 467 — 03.09.02-155 | 2          | 3        |
| RAI 467 — 03.09.02-156 | 4          | 4        |
| RAI 467 — 03.09.02-162 | 5          | 6        |

The schedule for technically correct and complete FINAL responses to the remaining 6 questions is unchanged as provided below.

| Question #             | Response Date     |
|------------------------|-------------------|
| RAI 467 — 03.06.03-28  | August 15, 2011   |
| RAI 467 — 03.09.02-157 | September 9, 2011 |
| RAI 467 — 03.09.02-160 | September 9, 2011 |
| RAI 467 — 03.09.02-161 | September 9, 2011 |
| RAI 467 — 03.09.02-163 | September 9, 2011 |
| RAI 467 — 03.09.02-165 | September 9, 2011 |

Sincerely,

*Russ Wells for*  
**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
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**From:** WELLS Russell (RS/NB)  
**Sent:** Wednesday, July 27, 2011 10:23 AM  
**To:** 'Tefaye, Getachew'  
**Cc:** WILLIFORD Dennis (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); RYAN Tom (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 6

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions. AREVA NP submitted Supplement 2 on April 15, 2011, Supplement 3 on May 27, 2011, and Supplement 4 on June 22, 2011, to provide a revised schedule for 9 of the 10 remaining questions. AREVA NP submitted RAI 467 Supplement 5 on July 7, 2011, which provided a technically correct and complete response to 1 of the remaining 10 questions.

The schedule for technically correct and complete responses to the remaining 9 questions has been changed as provided below.

| Question #             | Response Date            |
|------------------------|--------------------------|
| RAI 467 — 03.06.03-28  | August 15, 2011          |
| RAI 467 — 03.09.02-155 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-156 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-157 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-160 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-161 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-162 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-163 | <b>September 9, 2011</b> |
| RAI 467 — 03.09.02-165 | <b>September 9, 2011</b> |

Sincerely,

*Russ Wells for*  
**Dennis Williford, P.E.**  
**U.S. EPR Design Certification Licensing Manager**  
**AREVA NP Inc.**

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
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**From:** WILLIFORD Dennis (RS/NB)

**Sent:** Thursday, July 07, 2011 11:35 AM

**To:** Tesfaye, Getachew

**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WELLS Russell (RS/NB)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 5

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions. AREVA NP submitted Supplement 2 on April 15, 2011, Supplement 3 on May 27, 2011, and Supplement 4 on June 22, 2011, to provide a revised schedule for 9 of the 10 remaining questions.

The attached file, "RAI 467 Supplement 5 Response US EPR DC.pdf" provides a technically correct and complete response to 1 of the remaining 10 questions.

The following table indicates the respective pages in the response document, "RAI 467 Supplement 5 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

| Question #             | Start Page | End Page |
|------------------------|------------|----------|
| RAI 467 — 03.09.02-167 | 2          | 2        |

The schedule for technically correct and complete responses to the remaining 9 questions is unchanged as provided below.

| Question #             | Response Date   |
|------------------------|-----------------|
| RAI 467 — 03.06.03-28  | August 15, 2011 |
| RAI 467 — 03.09.02-155 | July 27, 2011   |
| RAI 467 — 03.09.02-156 | July 27, 2011   |
| RAI 467 — 03.09.02-157 | July 27, 2011   |
| RAI 467 — 03.09.02-160 | July 27, 2011   |
| RAI 467 — 03.09.02-161 | July 27, 2011   |
| RAI 467 — 03.09.02-162 | July 27, 2011   |
| RAI 467 — 03.09.02-163 | July 27, 2011   |
| RAI 467 — 03.09.02-165 | July 27, 2011   |

Sincerely,

***Dennis Williford, P.E.***

***U.S. EPR Design Certification Licensing Manager***

**AREVA NP Inc.**

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Charlotte, NC 28262

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**From:** WILLIFORD Dennis (RS/NB)

**Sent:** Wednesday, June 22, 2011 12:57 PM

**To:** 'Tesfaye, Getachew'

**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WELLS Russell

(RS/NB)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 4

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions. AREVA NP submitted Supplement 2 on April 15, 2011 and Supplement 3 on May 27, 2011, to provide a revised schedule for 9 of the 10 remaining questions

The schedule for 9 of the 10 questions, shown in bold below, has been changed. The schedule for the remaining question is unchanged. The schedule for technically correct and complete responses to the remaining questions is provided below.

| Question #                    | Response Date        |
|-------------------------------|----------------------|
| RAI 467 — 03.06.03-28         | August 15, 2011      |
| <b>RAI 467 — 03.09.02-155</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-156</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-157</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-160</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-161</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-162</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-163</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-165</b> | <b>July 27, 2011</b> |
| <b>RAI 467 — 03.09.02-167</b> | <b>July 27, 2011</b> |

Sincerely,

***Dennis Williford, P.E.***  
***U.S. EPR Design Certification Licensing Manager***  
***AREVA NP Inc.***

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Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

---

**From:** WILLIFORD Dennis (RS/NB)

**Sent:** Friday, May 27, 2011 11:11 AM

**To:** Tesfaye, Getachew

**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB); WELLS Russell (RS/NB); CORNELL Veronica (External RS/NB)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 3

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions. AREVA NP submitted Supplement 2 on April 15, 2011 to provide a revised schedule for 9 of the 10 remaining questions

The schedule for 9 of the 10 questions, shown in bold below, has been changed. The schedule for the remaining question is unchanged. The schedule for technically correct and complete responses to the remaining questions is provided below.

| Question #                    | Response Date        |
|-------------------------------|----------------------|
| RAI 467 — 03.06.03-28         | August 15, 2011      |
| <b>RAI 467 — 03.09.02-155</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-156</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-157</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-160</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-161</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-162</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-163</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-165</b> | <b>June 27, 2011</b> |
| <b>RAI 467 — 03.09.02-167</b> | <b>June 27, 2011</b> |

Sincerely,

***Dennis Williford, P.E.***  
***U.S. EPR Design Certification Licensing Manager***  
***AREVA NP Inc.***

7207 IBM Drive, Mail Code CLT 2B  
Charlotte, NC 28262  
Phone: 704-805-2223  
Email: [Dennis.Williford@areva.com](mailto:Dennis.Williford@areva.com)

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**From:** WELLS Russell (RS/NB)  
**Sent:** Friday, April 15, 2011 4:15 PM  
**To:** Tesfaye, Getachew  
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 2

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. AREVA NP submitted Supplement 1 on April 1, 2011 to provide technically correct and complete responses to 4 of the remaining 14 questions.

To allow additional time to interact with NRC staff, the schedule for technically correct and complete responses to 9 of the 10 has been changed and is provided below. The schedule for a technically correct and complete response to the remaining question is unchanged and is provided below:

| Question #                    | Response Date       |
|-------------------------------|---------------------|
| RAI 467 — 03.06.03-28         | August 15, 2011     |
| <b>RAI 467 — 03.09.02-155</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-156</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-157</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-160</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-161</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-162</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-163</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-165</b> | <b>May 27, 2011</b> |
| <b>RAI 467 — 03.09.02-167</b> | <b>May 27, 2011</b> |

*Sincerely,*

Russ Wells  
 U.S. EPR Design Certification Licensing Manager  
 AREVA NP, Inc.  
 3315 Old Forest Road, P.O. Box 10935  
 Mail Stop OF-57  
 Lynchburg, VA 24506-0935  
 Phone: 434-832-3884 (work)  
 434-942-6375 (cell)  
 Fax: 434-382-3884  
[Russell.Wells@Areva.com](mailto:Russell.Wells@Areva.com)

**From:** WELLS Russell (RS/NB)  
**Sent:** Friday, April 01, 2011 1:24 PM  
**To:** 'Tefsaye, Getachew'  
**Cc:** BENNETT Kathy (RS/NB); DELANO Karen (RS/NB); ROMINE Judy (RS/NB); RYAN Tom (RS/NB)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for the 14 questions of RAI No. 467 on February 24, 2011. The attached file, "RAI 467 Supplement 1 Response US EPR DC.pdf" provides technically correct and complete responses to 4 of the remaining 14 questions, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 467 Questions 03.09.02-158, 03.09.02-159, and 03.09.02-164.

The following table indicates the respective pages in the response document, "RAI 467 Supplement 1 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

| Question #             | Start Page | End Page |
|------------------------|------------|----------|
| RAI 467 — 03.09.02-158 | 6          | 6        |
| RAI 467 — 03.09.02-159 | 7          | 7        |
| RAI 467 — 03.09.02-164 | 12         | 12       |
| RAI 467 — 03.09.02-166 | 14         | 14       |

The schedule for technically correct and complete responses to the remaining questions is unchanged and is provided below:

| Question #             | Response Date   |
|------------------------|-----------------|
| RAI 467 — 03.06.03-28  | August 15, 2011 |
| RAI 467 — 03.09.02-155 | April 28, 2011  |
| RAI 467 — 03.09.02-156 | April 28, 2011  |
| RAI 467 — 03.09.02-157 | April 28, 2011  |
| RAI 467 — 03.09.02-160 | April 28, 2011  |
| RAI 467 — 03.09.02-161 | April 28, 2011  |
| RAI 467 — 03.09.02-162 | April 28, 2011  |
| RAI 467 — 03.09.02-163 | April 28, 2011  |
| RAI 467 — 03.09.02-165 | April 28, 2011  |
| RAI 467 — 03.09.02-167 | April 28, 2011  |

Sincerely,

Russ Wells

U.S. EPR Design Certification Licensing Manager

AREVA NP, Inc.

3315 Old Forest Road, P.O. Box 10935

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434-942-6375 (cell)

Fax: 434-382-3884

[Russell.Wells@Areva.com](mailto:Russell.Wells@Areva.com)

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**From:** WELLS Russell (RS/NB)

**Sent:** Thursday, February 24, 2011 2:08 PM

**To:** 'Tesfaye, Getachew'

**Cc:** DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); BRYAN Martin (External RS/NB)

**Subject:** Response to U.S. EPR Design Certification Application RAI No. 467, FSAR Ch. 3

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 467 Response US EPR DC.pdf" provides a schedule for a technically correct and complete response to the 14 questions.

The following table indicates the respective pages in the response document, "RAI 467 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

| Question #             | Start Page | End Page |
|------------------------|------------|----------|
| RAI 467 — 03.06.03-28  | 2          | 2        |
| RAI 467 — 03.09.02-155 | 3          | 3        |
| RAI 467 — 03.09.02-156 | 4          | 4        |
| RAI 467 — 03.09.02-157 | 5          | 5        |
| RAI 467 — 03.09.02-158 | 6          | 6        |
| RAI 467 — 03.09.02-159 | 7          | 7        |
| RAI 467 — 03.09.02-160 | 8          | 8        |
| RAI 467 — 03.09.02-161 | 9          | 9        |
| RAI 467 — 03.09.02-162 | 10         | 10       |
| RAI 467 — 03.09.02-163 | 11         | 11       |
| RAI 467 — 03.09.02-164 | 12         | 12       |
| RAI 467 — 03.09.02-165 | 13         | 13       |
| RAI 467 — 03.09.02-166 | 14         | 14       |
| RAI 467 — 03.09.02-167 | 15         | 15       |

A complete answer is not provided for the 14 questions. The schedule for a technically correct and complete response to these questions is provided below.

| Question # | Response Date |
|------------|---------------|
|------------|---------------|

|                        |                 |
|------------------------|-----------------|
| RAI 467 — 03.06.03-28  | August 15, 2011 |
| RAI 467 — 03.09.02-155 | April 28, 2011  |
| RAI 467 — 03.09.02-156 | April 28, 2011  |
| RAI 467 — 03.09.02-157 | April 28, 2011  |
| RAI 467 — 03.09.02-158 | April 28, 2011  |
| RAI 467 — 03.09.02-159 | April 28, 2011  |
| RAI 467 — 03.09.02-160 | April 28, 2011  |
| RAI 467 — 03.09.02-161 | April 28, 2011  |
| RAI 467 — 03.09.02-162 | April 28, 2011  |
| RAI 467 — 03.09.02-163 | April 28, 2011  |
| RAI 467 — 03.09.02-164 | April 28, 2011  |
| RAI 467 — 03.09.02-165 | April 28, 2011  |
| RAI 467 — 03.09.02-166 | April 28, 2011  |
| RAI 467 — 03.09.02-167 | April 28, 2011  |

Sincerely,

*Russ Wells*

*U.S. EPR Design Certification Licensing Manager*

**AREVA NP, Inc.**

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[Russell.Wells@Areva.com](mailto:Russell.Wells@Areva.com)

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**From:** Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]

**Sent:** Wednesday, January 26, 2011 3:34 PM

**To:** ZZ-DL-A-USEPR-DL

**Cc:** Reichelt, Eric; Terao, David; Wong, Yuken; Dixon-Herrity, Jennifer; Miernicki, Michael; Colaccino, Joseph; ArevaEPRDCPEm Resource

**Subject:** U.S. EPR Design Certification Application RAI No. 467 (5333, 5344), FSAR Ch. 3

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on January 6, 2011, and discussed with your staff on January 20 and 24, 2011. No change is made to the draft RAI as a result of those discussions. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,

Getachew Tesfaye

Sr. Project Manager

NRO/DNRL/NARP

(301) 415-3361



**Hearing Identifier:** AREVA\_EPR\_DC\_RAIs  
**Email Number:** 3363

**Mail Envelope Properties** (2FBE1051AEB2E748A0F98DF9EEE5A5D486D35F)

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No. 467, FSAR Ch. 3, Question 03.09.02-161  
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**Response to**

**Request for Additional Information No. 467(5333, 5344)  
Question 03.09.02-161**

**1/26/2011**

**U.S. EPR Standard Design Certification**

**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 03.06.03 - Leak-Before-Break Evaluation Procedures**

**SRP Section: 03.09.02 - Dynamic Testing and Analysis of Systems Structures and  
Components**

**Application Section: FSAR Chapter 3**

**QUESTIONS for Component Integrity, Performance, and Testing Branch 1  
(AP1000/EPR Projects) (CIB1)**

**QUESTIONS for Engineering Mechanics Branch 2 (ESBWR/ABWR Projects)  
(EMB2)**

**Question 03.09.02-161:**

FSAR Appendix 3C.2.1.1, paragraph 1 states “The RPV internals and fuel mass are lumped at the appropriate center of gravity locations.”

The staff noted the following:

- a. The fuel mass consists of a very large number of loose fuel pellets, constituting the active fuel length of 13.78 ft. inside the fuel rod with a total length of 14.93 ft. (they are most probably under pre-compression due to a spring). Due to the high density of the fuel pellets, the fuel pellets contribute the most significant mass to the fuel assembly. The applicant is requested to explain that under combined SSE and LOCA loads, the fuel pellets will behave dynamically like a rigid single lumped mass, instead of multiple masses.
- b. The fuel assemblies themselves are supported at the bottom by the bottom nozzle, while the top end is clamped down by the hold down spring. The applicant is requested to explain that with the presence of the hold down spring, the fuel assembly will behave like a rigid single lumped mass, instead of preloaded multiple masses, under combined SSE and LOCA loads.

**Response to Question 03.09.02-161:****Item a:**

U.S. EPR FSAR Tier 2, Section 3C.2.1.1, describes the modeling techniques used for the reactor pressure vessel (RPV) in the Reactor Coolant System (RCS) loop model. In this model of the RCS, the RPV is a simplified model used to obtain global response in calculating static, seismic, and pipe rupture external loads on the RPV, as well as other components, such as component support loads and primary nozzle loads. The internal components of the RPV are not modeled explicitly because they do not significantly affect the component shell stiffness. The masses of the internal components are included in order to achieve the correct total mass and center of gravity.

The RPV isolated model, discussed in U.S. EPR FSAR Tier 2, Section 3C.2.2, is a detailed model of the RPV and its internal components. This model includes explicit models of the internal components with distributed mass, geometric nonlinearities (i.e. gaps), and localized contact stiffnesses. The representative sketch of the RPV isolated model provided in U.S. EPR FSAR Tier 2, Figure 3C-8, illustrates some details of the model, such as multiple beam elements, contact stiffnesses, and geometric nonlinearities. This model is used to provide dynamic, seismic, and pipe rupture response of the RPV internals which includes the core barrel, heavy reflector, upper support plate, and lower core support plate.

The models in each case are developed using beam elements with 12 degrees of freedom, capable of supporting axial and shear forces as well as bending and torsional moments. The flexibility under transverse loading is calculated considering shear deflection as well as deflection due to bending.

The equations used to determine the flexibility of a cantilevered beam with end loads are provided below. The provided equations only provide the magnitude of flexibility. Signs are ignored for simplicity.

Axial flexibility of beam free end loaded by axial force:

$$C_{\text{axdaf}} = L/EA$$

Transverse flexibility of beam free end including shear displacement loaded by transverse force:

$$C_{\text{trdtf}} = \frac{L^3}{3EI_b} + \frac{KL}{GA}$$

Transverse flexibility of beam free end loaded by bending moment:

$$C_{\text{trdbm}} = \frac{L^2}{2EI_b}$$

Rotational flexibility of beam free end loaded by transverse force:

$$C_{\text{andtf}} = \frac{L^2}{2EI_b}$$

Rotational flexibility of beam free end loaded by bending moment:

$$C_{\text{andbm}} = \frac{L}{EI_b}$$

Rotational flexibility of beam free end loaded by torsional moment:

$$C_{\text{andtm}} = \frac{L}{GJ}$$

Where:

L = Beam Length

E = Beam Young's Modulus

I<sub>b</sub> = Beam Bending Moment of Inertia

J = Beam Polar Moment of Inertia

G = Beam Shear Modulus = E/(2(1+v))

$\nu$  = Beam Poisson's Ratio

A = Beam Cross Sectional Area

K = Beam Shear Deflection Factor (typically calculated using Reference 1)

In developing the RPV isolated model, each point where internal components are capable of interacting is evaluated to determine the operating condition gap and contact stiffness. In certain areas where contact is possible, the contact stiffness is modeled as a nonlinear spring with increasing stiffness due to changes in geometry caused by formation of the internal components. Each connection that incorporates a spring is modeled explicitly, including the fuel holddown spring and core barrel/upper support holddown spring. In addition, the fuel assemblies are modeled as distributed mass elements with springs at the top representing the holddown springs and gapped elements representing the contact stiffness between the grids and the heavy reflector.

The individual fuel assemblies are constructed with end fittings, fuel rods containing fuel pellets, and lateral support grids. Radial clearance between the fuel pellets and the cladding in the cold condition is approximately 0.003 inches and reduces further under power conditions until full contact between the fuel pellets and cladding is achieved. The reduction in clearance is caused by fuel pellet swelling, differential thermal expansion between the fuel pellets, and cladding and external pressure on the cladding from the RCS fluid. There is no relative movement between the fuel pellets and the cladding as the two components become bonded when in contact. This creates a rigid connection between the cladding and the fuel pellets.

When a structure is submerged under water, the behavior of the structure can be impacted by the presence of water. In particular, in the case of a narrow annulus of water between two cylindrical structures, the water may cause the two structures to move together, altering the two structures' natural frequencies. This effect is accounted for using the methodology of ASCE 4-95, which provides calculations for "hydromass", including mass coupling terms between submerged collinear structures, such as the heavy reflector and core barrel in the RPV.

**Item b:**

See response to Item a.

**References for Question 03.09.02-161**

1. Cowper, G. R., "The Shear Coefficient in Timoshenko's Beam Theory," Journal of Applied Mechanics 33, No. 2, 1966, Transactions of the ASME.

**FSAR Impact:**

The U.S. EPR FSAR will not be changed as a result of this question.